WHAT IS CLAIMED IS:

1   1.   A system for sending low rate data on a packet basis in

2   an 8-VSB standard data packet stream, said system comprising:

3   an 8-VSB signal transmitter capable of transmitting a low rate

4   data packet that comprises data bytes that contain both information

5   bearing bits and non-information bearing bits.

1   2.   The system for sending low rate data on a packet basis in

2   an 8-VSB standard data packet stream as claimed in Claim 1 wherein

3   said 8-VSB signal transmitter is capable of determining the values

4   of said non-information bearing bits in said low rate data packet

5   so that said non-information bearing bits will be correctly

6   encoded.

1   3.   The system for sending low rate data on a packet basis in

2   an 8-VSB standard data packet stream as claimed in Claim 1 wherein

3   said low rate data packet comprises data bytes in which half of the

4   bits in each data byte contain information and half of the bits in

5   each data byte do not contain information.

1   4.   The system for sending low rate data on a packet basis in

2   an 8-VSB standard data packet stream as claimed in Claim 3 wherein

3   said 8-VSB signal transmitter is capable of determining the values

4   of said bits that do not contain information so that said bits that

5   do not contain information will be correctly encoded.

1   5.   The system for sending low rate data on a packet basis in

2   an 8-VSB standard data packet stream as claimed in Claim 3 wherein

3   said low rate data packet comprises eight (8) bit data bytes in

4   which bit 6, bit 4, bit 2, and bit 0 in each data byte contain

5   information and in which bit 7, bit 5, bit 3, and bit 1 in each

6   data byte do not contain information.

1   6.   The system for sending low rate data on a packet basis in

2   an 8-VSB standard data packet stream as claimed in Claim 5 wherein

3   said 8-VSB signal transmitter is capable of determining the values

4   of bit 7, bit 5, bit 3, and bit 1 so that they will be correctly

5   encoded.

1   7.   The system for sending low rate data on a packet basis in

2   an 8-VSB standard data packet stream as claimed in Claim 6 wherein

3   said 8-VSB signal transmitter determines the values of bit 7, bit

4   5, bit 3, and bit 1 so that each output symbol is from one of the

5   four levels -7, -3, + 3, and +7 by setting the value of the Z_2 bit

6   from a trellis encoder of said 8-VSB signal transmitter equal to

7   the value of the Z_0 bit from said trellis encoder.

1   8.   The system for sending low rate data on a packet basis in

2   an 8-VSB standard data packet stream as claimed in Claim 7 wherein

3   said 8-VSB signal transmitter determines the values of bit 7, bit

4   5, bit 3, and bit 1 by calculating the values of bit 7, bit 5, bit

5   3, and bit 1 from the expression:

6            $$X_2(k) = Z_2(k) \oplus Z_2(k - 12)$$

7   where $X_2(k)$ represents the value of a bit before the bit is input

8   to a pre-coder of said trellis encoder, and where Z_2 represents the

9   value of a bit after the bit is output from said trellis encoder,

10   and where k is a time index, and where the operator $\oplus$ signifies a

11   logical exclusive OR operation.

1   9.   A system for sending half rate data on a packet basis in

2   an 8-VSB standard data packet stream in an 8-VSB signal transmitter

3   of the type comprising a Reed Solomon encoder, a data interleaver,

4   and a trellis encoder, wherein said system comprises:

5   a first data packet switch before said Reed Solomon encoder

6   capable of determining whether a data packet is a full rate data

7   packet or a half rate data packet, said first data packet switch

8   capable of sending a full rate data packet to said Reed Solomon

9   decoder and capable of sending a half rate data packet to said data

10   interleaver; and

11   a second data packet switch after said trellis encoder capable

12   of determining whether a data packet is a full rate data packet or

13   a half rate data packet, said second data packet switch capable of

14   sending a full rate data packet to a multiplexer and capable of

15   sending a half rate data packet to an exclusive OR unit.

1   10.   The system for sending half rate data on a packet basis

2   in an 8-VSB standard data packet stream as claimed in Claim 9

3   wherein said exclusive OR unit is capable of determining the values

4   of bits in a half rate data packet that do not contain information

5   so that said bits that do not contain information will be correctly

6   encoded.

1   11.   The system for sending half rate data on a packet basis

2   in an 8-VSB standard data packet stream as claimed in Claim 10

3   wherein said half rate data packet comprises eight (8) bit data

4   bytes in which bit 6, bit 4, bit 2, and bit 0 in each data byte

5   contain information and in which bit 7, bit 5, bit 3, and bit 1 in

6   each data byte do not contain information; and

7   wherein said exclusive OR unit is capable of determining the

8   values of bit 7, bit 5, bit 3, and bit 1 so that each output symbol

9   is from one of the four levels -7, -3, + 3, and +7 by setting the

10   value of the Z_2 bit from said trellis encoder equal to the value of

11   the Z_0 bit from said trellis encoder.

1 12. The system for sending half rate data on a packet basis

2 in an 8-VSB standard data packet stream as claimed in Claim 11

3 wherein said exclusive OR unit is capable of determining the values

4 of bit 7, bit 5, bit 3, and bit 1 by calculating the values of

5 bit 7, bit 5, bit 3, and bit 1 from the expression:

6 $$X_2(k) = Z_2(k) \oplus Z_2(k - 12)$$

7 where $X_2(k)$ represents the value of a bit before the bit is input

8 to a pre-coder of said trellis encoder, and where Z_2 represents the

9 value of a bit after the bit is output from said trellis encoder,

10 and where k is a time index, and where the operator $\oplus$ signifies a

11 logical exclusive OR operation.

1 13. The system for sending half rate data on a packet basis

2 in an 8-VSB standard data packet stream as claimed in Claim 12

3 wherein an output of said exclusive OR unit is coupled to an input

4 of said Reed Solomon encoder; and wherein said exclusive OR unit is

5 capable of sending a half rate data packet to said Reed Solomon

6 encoder in which the values of bit 7, bit 5, bit 3, and bit 1 in

7 each data byte of said half rate data packet have been determined

8 so that all eight (8) bits in each data byte of said half rate data

9 packet will be correctly encoded.

1   14. The system for sending half rate data on a packet basis

2   in an 8-VSB standard data packet stream as claimed in Claim 13

3   further comprising:

4   a permutation unit located after said Reed Solomon encoder and

5   before said data interleaver, said permutation unit capable of

6   determining whether a data packet is a full rate data packet or a

7   half rate data packet, said permutation unit capable of sending a

8   full rate data packet to said data interleaver without performing

9   a permutation, said permutation unit capable of permuting the bytes

10   in a half rate data packet to ensure that parity byte positions do

11   not occur before the data byte positions in each data packet.

1   15. The system for sending half rate data on a packet basis

2   in an 8-VSB standard data packet stream as claimed in Claim 14

3   wherein said permutation unit is capable of setting a rate bit in

4   a field sync segment of said half rate data packet to change the

5   status of said half rate data packet from half rate status to full

6   rate status.

1   16.   The system for sending half rate data on a packet basis

2   in an 8-VSB standard data packet stream as claimed in Claim 15

3   further comprising an 8-VSB signal receiver comprising:

4   a reverse permutation unit located between a data de-

5   interleaver and a Reed Solomon decoder, said reverse permutation

6   unit capable of reversing the permutation of bytes carried out by

7   said permutation unit of said 8-VSB signal transmitter.

1   17.   A method for sending low rate data on a packet basis in

2   an 8-VSB standard data packet stream, said method comprising the

3   steps of:

4   placing data in a low rate data packet that comprises data

5   bytes that contain both information bearing bits and non-

6   information bearing bits;

7   determining the values of said non-information bearing bits in

8   said low rate data packet so that said non-information bearing bits

9   will be correctly encoded; and

10   transmitting said low rate data packet with an 8-VSB signal

11   transmitter.

1   18.   The method for sending low rate data on a packet basis in

2   an 8-VSB standard data packet stream as claimed in Claim 17 wherein

3   said low rate data packet comprises data bytes in which half of the

4   bits in each data byte contain information and half of the bits in

5   each data byte do not contain information.

1   19.   The method for sending low rate data on a packet basis in

2   an 8-VSB standard data packet stream as claimed in Claim 17 wherein

3   the step of placing data in a low rate data packet that comprises

4   data bytes that contain both information bearing bits and non-

5   information bearing bits comprises the steps of:

6   placing data in bit 6, bit 4, bit 2, and bit 0 in each eight

7   (8) bit data byte so that bit 6, bit 4, bit 2, and bit 0 are

8   information bearing bits; and

9   placing no data in bit 7, bit 5, bit 3, and bit 1 in each

10 eight (8) bit data byte so that bit 7, bit 5, bit 3, and bit 1 are

11 non-information bearing bits.

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1   20. The method for sending low rate data on a packet basis in

2   an 8-VSB standard data packet stream as claimed in Claim 19 wherein

3   the step of determining the values of said non-information bearing

4   bits in said low rate data packet so that said non-information

5   bearing bits will be correctly encoded comprises the step of:

6   setting the value of the Z_2 bit from a trellis encoder of said

7   8-VSB signal transmitter equal to the value of the Z_0 bit from said

8   trellis encoder so that each output symbol is from one of four

9   levels -7, -3, +3, and +7; and

10   calculating the values of bit 7, bit 5, bit 3, and bit 1 from

11 the expression:

12              $$X_2(k) = Z_2(k) \oplus Z_2(k - 12)$$

13 where $X_2(k)$ represents the value of a bit before the bit is input

14 to a pre-coder of said trellis encoder, and where Z_2 represents the

15 value of a bit after the bit is output from said trellis encoder,

16 and where k is a time index, and where the operator $\oplus$ signifies a

17 logical exclusive OR operation.

1   21.   The method for sending low rate data on a packet basis in

2   an 8-VSB standard data packet stream as claimed in Claim 20 further

3   comprising the steps of:

4   permuting the bytes in said low rate data packet to ensure

5   that parity byte positions of said low rate data packet do not

6   occur before the data byte positions in each low rate data packet;

7   and

8   reverse permuting said permuted bytes in said low rate data

9   packet after said low rate data packets are received in an 8-VSB

10   signal receiver.

1   22. The method for sending low rate data on a packet basis in

2   an 8-VSB standard data packet stream as claimed in Claim 19 further

3   comprising the steps of:

4   sending said low rate data packet through a data interleaver;

5   sending said low rate data packet through a trellis encoder;

6   sending said low rate data packet through an exclusive OR

7   unit;

8   sending said low rate data packet through a Reed Solomon

9   encoder;

10   sending said low rate data packet through a permutation unit;

11   sending said low rate data packet through said data

12   interleaver a second time; and

13   sending said low rate data packet through said trellis encoder

14   a second time.

1   23. A high definition television system comprising a system

2   for sending low rate data on a packet basis in an 8-VSB standard

3   data packet stream, said system comprising:

4   an 8-VSB signal transmitter capable of transmitting a low rate

5   data packet that comprises data bytes that contain both information

6   bearing bits and non-information bearing bits.

1   24. The high definition television system as claimed in Claim

2   23 wherein said 8-VSB signal transmitter is capable of determining

3   the values of said non-information bearing bits in said low rate

4   data packet so that said non-information bearing bits will be

5   correctly encoded.

1   25. The high definition television system as claimed in Claim

2   23 wherein said low rate data packet comprises eight (8) bit data

3   bytes in which bit 6, bit 4, bit 2, and bit 0 in each data byte

4   contain information and in which bit 7, bit 5, bit 3, and bit 1 in

5   each data byte do not contain information; and wherein said 8-VSB

6   signal transmitter is capable of determining the values of bit 7,

7   bit 5, bit 3, and bit 1 so that they will be correctly encoded.

1   26. The high definition television system as claimed in Claim

2   25 wherein said 8-VSB signal transmitter determines the values of

3   bit 7, bit 5, bit 3, and bit 1 so that each output symbol is from

4   one of the four levels -7, -3, + 3, and +7 by setting the value of

5   the Z_2 bit from a trellis encoder of said 8-VSB signal transmitter

6   equal to the value of the Z_0 bit from said trellis encoder.

1   27.   The high definition television system as claimed in Claim

2   26 wherein said 8-VSB signal transmitter determines the values of

3   bit 7, bit 5, bit 3, and bit 1 by calculating the values of bit 7,

4   bit 5, bit 3, and bit 1 from the expression:

5    $$X_2(k) = Z_2(k) \oplus Z_2(k - 12)$$

6   where $X_2(k)$ represents the value of a bit before the bit is input

7   to a pre-coder of said trellis encoder, and where Z_2 represents the

8   value of a bit after the bit is output from said trellis encoder,

9   and where k is a time index, and where the operator $\oplus$ signifies a

10   logical exclusive OR operation.

1   28.   The high definition television system as claimed in Claim

2   27 further comprising:

3   a permutation unit located after a Reed Solomon encoder and

4   before a data interleaver in said 8-VSB signal transmitter, said

5   permutation unit capable of permuting the bytes in a half rate data

6   packet to ensure that parity byte positions do not occur before the

7   data byte positions in each data packet.

1   29.   The high definition television system as claimed in Claim

2   28 further comprising:

3   an 8-VSB signal receiver comprising a reverse permutation unit

4   located between a data de-interleaver and a Reed Solomon decoder of

5   said 8-VSB signal receiver, said reverse permutation unit capable

6   of reversing the permutation of bytes carried out by said

7   permutation unit of said 8-VSB signal transmitter.